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APPENDIX 22

DATA REDUCTION WITH STE

FINAL SOFTWARE REPORT

DATA ITEM NO. A005

INTEGRATED ELECTRONIC WARFARE SYSTEM
ADVANCED DEVELOPMENT MODEL (ADM)

PREPARED FOR:

NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PENNSYLVANIA

CONTRACT N62269-75-C-0370

RAYTHEON
ELECTROMAGNETIC
SYSTEMS DIVISION

1 OCTOBER 1977

UNCLASSIFIED

APPENDIX 22

DATA REDUCTION
FINAL SOFTWARE REPORT
DATA ITEM A005

INTEGRATED ELECTRONIC WARFARE SYSTEM (IEWS)
ADVANCED DEVELOPMENT MODEL (ADM)

Contract No. N62269-75-C-0070

Prepared for:

Naval Air Development Center
Warminister, Pennsylvania

Prepared by:

RAYTHEON COMPANY
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1 OCTOBER 1977

RAYTHEON	RAYTHEON COMPANY LEXINGTON, MASS. 02173	CODE IDENT NO. 49956	SPEC NO. 53959-RB-0775 SHEET 1 OF / REV

TYPE OF SPEC

IEWS Test Software

TITLE OF SPEC

STE Data Reduction

FUNCTION	APPROVED	DATE	FUNCTION	APPROVED	DATE
WRITER					

REVISIONS

CHK	DESCRIPTION	REV	CHK	DESCRIPTION	REV

REVISION																							
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I. DATA REDUCTION SOFTWARE FOR DEMONSTRATION

A. Sequential and Simultaneous Start-Up

1. Requirement - Emitters in a given scenario will be activated either sequentially or simultaneously. The acquisition time, parameter values, ID codes, and response codes shall be provided for each emitter.

2. Output Data Format - The format for a page of output data shall be as shown in either Figure 1 or Figure 2. The listing shall provide a time history of significant events in the processing. Two capabilities shall be provided: an unsorted sequential time history and a time history sorted by EFN.

3. Detailed Design - Each of the events shall correspond to messages within the SC which shall be output by means of data extraction points. The correspondence between events, messages, and the location of the data extraction points shall be as shown in Table I.

B. Response Status

1. Requirement - In steady-state condition periodically output priority, technique, and jamming status.

2. Output Data Format - The format for the response status shall be as shown in Figure 3. This data shall be updated and displayed every 10 seconds and whenever there is a change in Priority or Technique assignment as long as the output is enabled.

UNSORTED TIME HISTORY

EVENT	EFN	ELN	TOD MSEC	FREQ MHZ	PRI USEC	PW USEC	STYP	SPRD MSEC	ID	TECH
ACQ	10	3	000042	9250	550	< 0.2				
CLASS	10	3	000297	9250	550	0.50	CIR	1500	AAA	
ACQ	11	7	000300	4635	1000	0.35				
RSPNS	10	3	000306	9250	550	0.6	CIR	1500	AAA	006M
CLASS	11	7	000560	4635	1000	1-4	CIR	2600	AI	
ACQ	26	6	000642	10506	730	0.8				
CLASS	26	6	000951	10506	730	>3.6	SEC	35	SA-3	
RSPNS	11	7	000965	4635	1000	0.40	CIR	2600	AI	028M
RSPNS	26	6	000968	10506	730	0.6	SEC	35	SA-3	117
DLTN	26	6	001570							
DLTN	10	3	002631							
DLTN	11	7	002750							

Figure 1. Unsorted Time History

EVENT	EFN	ELN	TOD MSEC	FREQ MHZ	PRI USEC	PW USEC	STYP	SPRD MSEC	ID	TECH
ACQ	10		000012	9250	550	.30				
CLASS	10	3	000262	9250	550	.30	CIR	1500	AAA	0000
RSPNS	10	3	000275	9250	550	.30	CIR	1500	AAA	0006
UPDT	10	3	001550	9250	550	.30	SEC	107	AAA	0006
RSPNS	10	3	001560	9250	550	.30	SEC	107	AAA	0035
UPDT	10	3	002756	9250	550	.30	SEC	107	AAA	0035
DLTN	10	3	003010							

FIGURE 2. SORTED TIME HISTORY

TABLE I. EVENT DESCRIPTION

Event	SC Message	S/W Module	DE Output
ACQ	NE Alert	SONE1	ETF Contents
CLASS	Update Msg.	ANAMB	ETF Contents
UPDT	Update Msg.	SOOC1	ETF Contents
		ANOC2	ETF Contents
		ANOC3	ETF Contents
		ANOC4	ETF Contents
RSPNS	Aux Bus Control	RMRAI	ETF Contents
DLTN	Delete File	SODEL	EFN, TOD

RESPONSE STATUS

TOD = 001234 HEADING = 12 DEG ALTITUDE = 10,000 FT

PRIOR	TYPE	ANG	TECH
000	AI	268	001M
001	SA-2	32	045
002M	SA-3	18	
003	AAA	193	009
.	.	.	.
.	.	.	.
.	.	.	.

CHANNEL ASSIGNMENT

CHAN	EFN
0	10
1	28
2	116
.	.
.	.
.	.
15	18

Figure 3. Response Status

3. Detailed Design - Each time the AN display is updated the SC shall output the data for Figure 3. The bearing and altitude shall be the current values of SYHDC and SYALC, respectively. The priority status shall be derived from the contents of the threat total, the priority file and those ETF entries which are referenced in the Priority File. The channel assignment shall be the contents of the jam status file. There shall be sufficient DE points in sub-program DCDLC to output this data.

   In running the tests, the data for the print-out shall be dumped directly to the floppy disc (FD) as received from the SC. To output Figure 1, the operator shall request all data between two values of time-of-day (TOD), $[T_1, T_2]$. To output Figure 2, the operator shall request all data in $[T_1, T_2]$ for a specific track file from the FD.

   As each page of data is filled, there shall be an automatic advance to the next page where the header shall be repeated.

   As each page of data is filled, there shall be an automatic advance to the next page where the header, RESPONSE STATUS -- date shall be repeated. The data output shall then be continued.

C. Output Device

The operator shall be able to cause the above outputs to be sent to either or both of two output devices.

II. DATA REDUCTION SOFTWARE FOR PERFORMANCE EVALUATION

A. Processor Loading

1. Requirement - Determine the percentage of time spent in background ECM processing, executive overhead processing, I/O processing, and idle loop processing.

2. Processing - The data reduction software shall subtract the entry time from the exit time of each sub-program monitored and shall accumulate run times for each of the catagories in 1.) above. These times shall be used to calculate percentages of the total time for the test run. The data reduction software shall also monitor the number of messages input from the sorter the number of interprocessor messages, and the initial and final number of emitters in the system.

3. Output Data Format - The format for a page of data output shall be as shown in Figure 4.

4. Detailed Design - Each module to be monitored shall have a DE point at its entry and a DE point at its exit. Time not spent in background, I/O or the idle loop shall be considered as executive overhead. The message traffic shall be monitored by outputting DE messages each time a message is received or sent via the sorter message handler or the interprocessor communications module. Data shall be displayed for a time period specified by the operator.

PROCESSOR LOADING

PROCESSOR = CLASS

SS MSGS = 10

RCVD IP MSGS = 5

SENT IP MSGS = 6

INITIAL EMITTERS = 5

FINAL EMITTERS = 6

START TIME = 001234

TYPE PROC	TIME, MSEC	PERCENT
BACKGROUND	90	45
EXECUTIVE	20	10
I/O	10	5
IDLE LOOP	80	40
TOTAL	200	100

Figure 4. Processor Loading Format

B. Message Traffic

1. Requirement - Determine the distribution of message traffic in the SC.

2. Output Data Format - The format for a page of data output shall be as shown in Figure 5.

3. Detailed Design - Data extraction points shall be placed in the sorter message handler and in the interprocessor communication modules to output all message traffic. The messages shall be divided into the following catagories:

NE Alert	Analysis Start
PTDW	Analysis Return
Inactive File Alert	Update
SPDW Request	Aux Bus Control
Stop SPDWS	All Others
Delete File	

The data reduction software shall count the numbers of messages of each type and calculate the percentages relative to the total number of messages received. The data reduction software shall also display the initial time of the period monitored and the initial and final number of emitters. The results shall be printed out as shown in Figure 5. Data shall be displayed for a time period specified by the operator.

MESSAGE TRAFFIC

START TIME 001234

INITIAL EMITTERS = 5

FINAL EMITTERS = 4

MESSAGE	NO RCVD.	PERCENT
NE ALERT	10	4
PTDW	36	15
INACT FILE ALRT	9	4
DELETE FILE	9	4
ANALYSIS START	25	10
ANALYSIS RETURN	25	10
SPDW REQUEST	35	14
STOP SPDW'S	25	10
AUX BUS CONTROL	10	4
UPDATE	46	19
OTHERS	15	6
TOTAL	245	100

Figure 5. Message Traffic Format

C. Scan Analysis

1. Requirements - Produce plots of scan analysis patterns from sorted PDW data.

2. Processing - The data reduction software shall extract amplitude and TOA from the PDW data and shall form a bar graph on the printer. The length of each bar shall be proportional to the amplitude in dB (one asterisk = 1.6 dB). The difference between the last two TOA's shall be shown also. Missing pulses shall be shown as blank lines. Scan statistics shall be displayed also.

3. Output Data Format - The data format for the output shall be as shown in Figure 6.

4. Detailed Design - The STE shall accept SPDW's from the aux bus monitor and scan statistics (mean, variance, test statistic) from the scan analysis software, and shall store them on floppy disc (FD). The data reduction software shall extract SPDW's only for the EFN being output and shall extract the amplitude and TOA. The operator shall input a priori, a PRI value which the data reduction software shall use to look for missing pulses. Starting with the TOA of the first pulse, the software shall add a PRI value to it and compare the ATOA with the TOA of the next pulse. If there is a match within specified limits, the software shall output a line of asterisks of a length equal to the amplitude field and the difference between the last two TOA's. If there is no match, the software shall add the PRI to the new TOA and

SCAN PATTERN

EFN = 21 TO = 000000

MEAN = 17 VARIANCE = 3.1 TEST STATISTIC = 0.18

AMP	PRI
***	1023
*****	2046
********	1023
*********	1023
**********	1023
*********	1023
*******	1023
****	2046
***	1023
*	1023
***	2046
**	1023
**	1023
*	1023
****	4092
*****	1023
*****	1023
**********	1023
**********	1023

Figure 6. Scan Pattern Plot

look for the next pulse. If there is no match, the software shall output a blank line, shall increment the A TOA by the PRI value, and shall look for the next pulse. The process shall continue until the record on FD is exhausted or until the operator terminates the process whichever occurs first. Scan statistics shall be displayed also.

D. PDW Data

1. Requirement - Display PDW data in decoded format as a time ordered list.

2. Output Data Format - The output data format shall be as shown in Figure 7.

3. Detailed Design - The STE shall accept UPDW's or SPDW's from the aux bus monitor and shall store them on the FD. The data reduction software shall read the PDW's from the disc and decode and display the fields as shown in Figure 7. All PDW's or PDW's for one ETF entry shall be displayed for a time period designated by the operator. As each page of data is filled, there shall be an automatic advance to the next page where the header shall be repeated.

E. Output Devices

The operator shall be able to cause the above outputs to be sent to either or both of two output devices.

PDW DUMP

SC	ET	JID	UP	ETF	FREQ	CW	MF	DATA	AZ	AMP	PW	L1	L2	ML	TOA
S	E	15	S	127	9250	0	0	46	012	-17	3	0	0	0	0000582
0	E	0	U	27	4651	0	0	46	013	-25	5	0	0	0	0000641
S	0	0	S	45	2250	0	0	46	013	-5	7	0	0	0	0001001

Figure 7. PDW Dump Format